3S6410-B Users Manual
Part 1 - Introduction

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OK6410-B is an Embedded Computer (Single Board Computer) based on the 667MHz Samsung S3C6410 (ARM11) microcontroller. OK6410-B embodies abundant of built-in resources and powerful video processing capacity, which make the OK6410-B reliable for the development of higher-end products.

Together with the OK6410-B we provide BSPs (Board Support Packages) for Embedded Linux, WindowsCE and Android including basic drivers for all the components on the board and illustrating programs, which we believe can help the users in understanding the ARM architecture and shortening their development circle.

Here are some dos and don'ts for using the OK6410-B:

1. After opening the OK6410-B package, please check and make sure that the following components are all enclosed:

- 1 × OK6410-B board
- 1 × serial port cable
- 1 × USB cable
- 1 × Ethernet cable
- 1 × 5V power supply
- 1 × DVD

2. After purchasing the OK6410-B, please do inform us with your purchase information, including your name, registered email address, purchase date, invoice number and board ID to validate your membership for downloading the latest data from our website.

3. When using the Development Board for the first time, please do read and follow the user manual to prevent unnecessary troubles and damages.

4. Every time before powering on the Development Board, please touch anyone of the metallic interface with your fingers to unload the Electrostatic. Do not touch the chips with your fingers!

5. Before physically operating the Development Board, please switch the power off. Hot plugging is **not** supported except on the USB and Ethernet interfaces.

6. We provide for the OK6410-B 12 weeks' guarantee (in the precondition of non-artificial damage) and 24 weeks technical support.

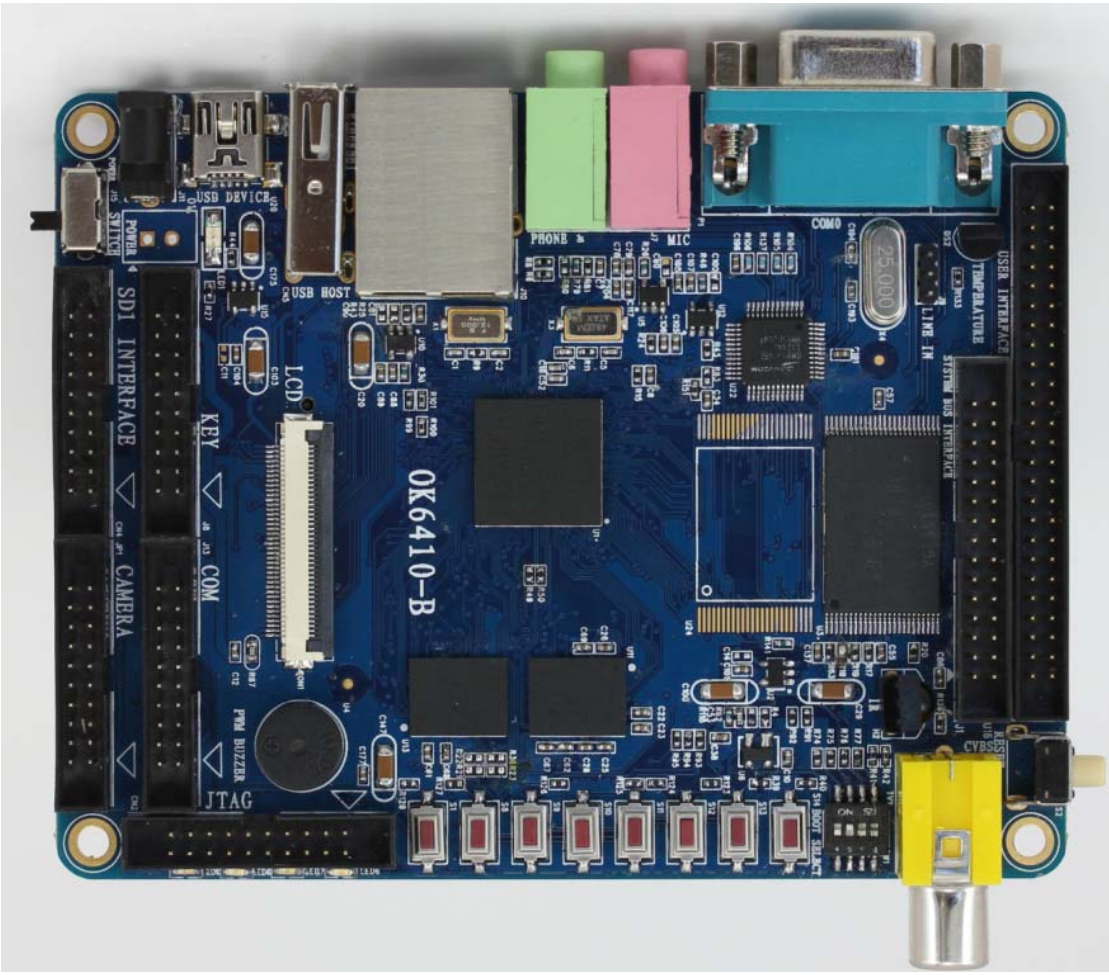
1. Brief Introduction

Along with the development of micro electronics, the ARM11 architecture is becoming more and more popular in higher-end products and embedded applications.

The Witech OK6410-B-B Development Board is based on the Samsung ARM11 microcontroller S3C6410 (667MHz), which embodies abundant of built-in resources and powerful video processing capacity and supports mobileDDR and various models of Nand Flash. Which, together with the integrated useful interfaces such as TV-out, CAMERA, USB, SD, LCD, Ethernet, and etc, makes the OK6410-B Development Board a powerful device for developing and implementing kinds of industrial products.

The OK6410-B Development Board is the single board version of OK6410, designed in conformity with CE standard with full consideration to high speed signal competence, EM compatibility, and static protection and etc, to ensure stable performance under various environments. Measuring 81 x 105mm only, the OK6410-B is the smallest S3C6410 development board till now.

Together with the OK6410-B we provide BSP (Board Support Packages) for Windows CE6.0, Embedded Linux-2.6, Uc/OS-II and Android 2.1, which provide drivers for all the bottom interfaces and devices and utility applications.



2. Hardware Features

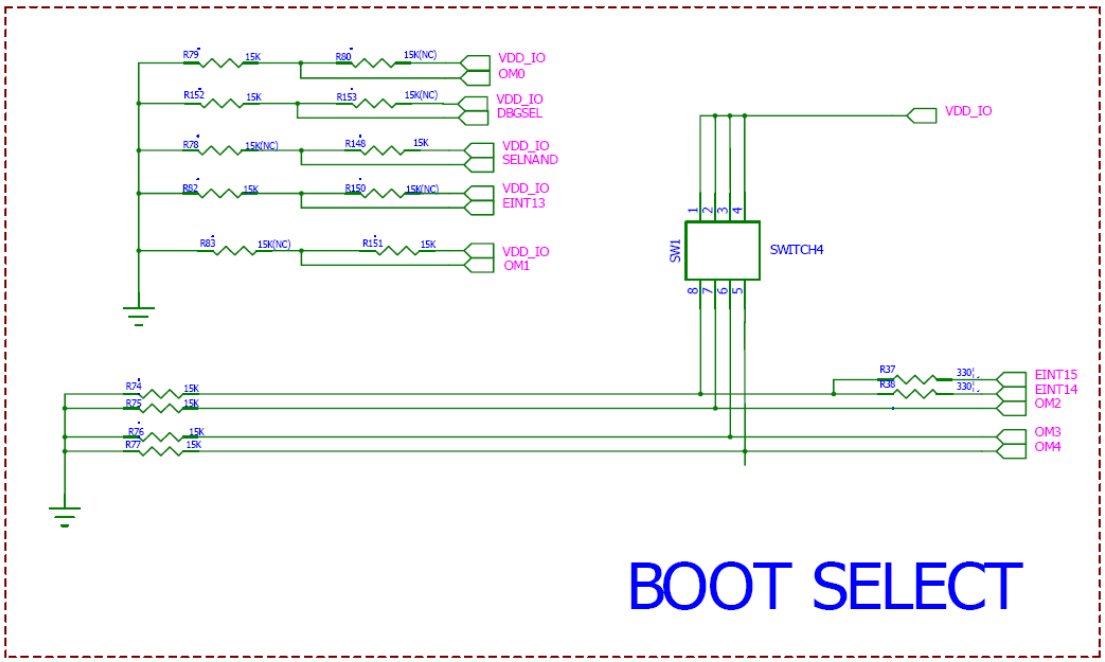
- 6 layer PCB, stable performance tested through electromagnetism
- Samsung S3C6410 microcontroller based on the ARM1176JZF-S core, main frequency @ 533/667MHz;
- 128MB Mobile DDR RAM;
- 256MB NAND Flash;
- (256MB RAM + 2GB NAND Flash version available)
- 12MHz、48MHz、27MHz、32.768KH clock source;
- 5V power supply.
- One reset button implemented with specific reset chip;
- 4-bit toggle switch for selecting boot mode;
- Four serial ports, including 1 5-wire RS232 (DB9) and 3 3-wire TTL (20pin 2.0mm-pitch connecotr);
- One 100M Ethernet port with DM9000AE and indicators;
- One USB Host interface supporting USB1.1 protocol;
- One USB Slave (MINI-USB) interface supporting USB2.0 protocol;
- One high-speed SD card slot supporting SD Memory and SDIO;
- One WIFI expansion interface;
- Two 3.5mm standard Stereo audio I/O sockets;
- One audio Line-In interface
- LCD and touch screen interface supporting 3.5”, 4.3”, 5.6”, 5.7”, 7”, 8” TFT LCD;
- One CVBS output interface (PAL/NTSC)
- One CMOS camera connector supporting ITU-R BT601/656 8-bit mode;
- Built-in RTC (Real Time Clock) with back-up battery;
- One JTAG interface using 2*10pin connector;
- One digital temperature sensor (DS18B20);
- One Infrared receiver;
- Four user LEDs;
- One Buzzer;
- One 8x8 Keypad connector
- One 2*10pin serial port expansion interface. Including three TTL serial ports and 6 GPIO.
- One 2*15pin system bus interface
- One 2*25 GPIO interface.

3. Boot Modes

The OK6410-B supports booting from NAND Flash or SD card, we can set the boot source by setting 4-bit toggle switch SW2.

Pins	Pin 1	Pin 2	Pin 3	Pin 4
NAND Flash	OFF	ON	OFF	OFF
SD card	OFF	ON	ON	ON

The schematic of the boot mode selector is shown as below:



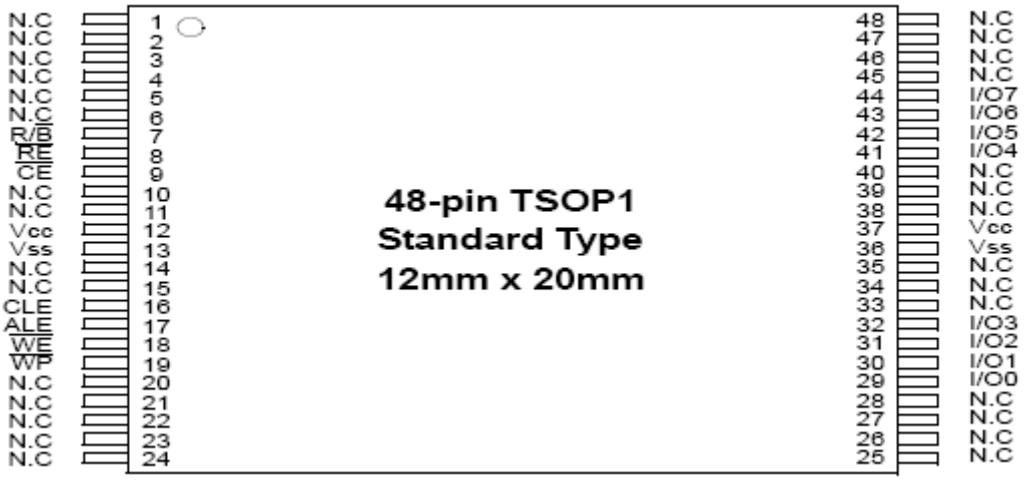
4. Schematics and Device Details

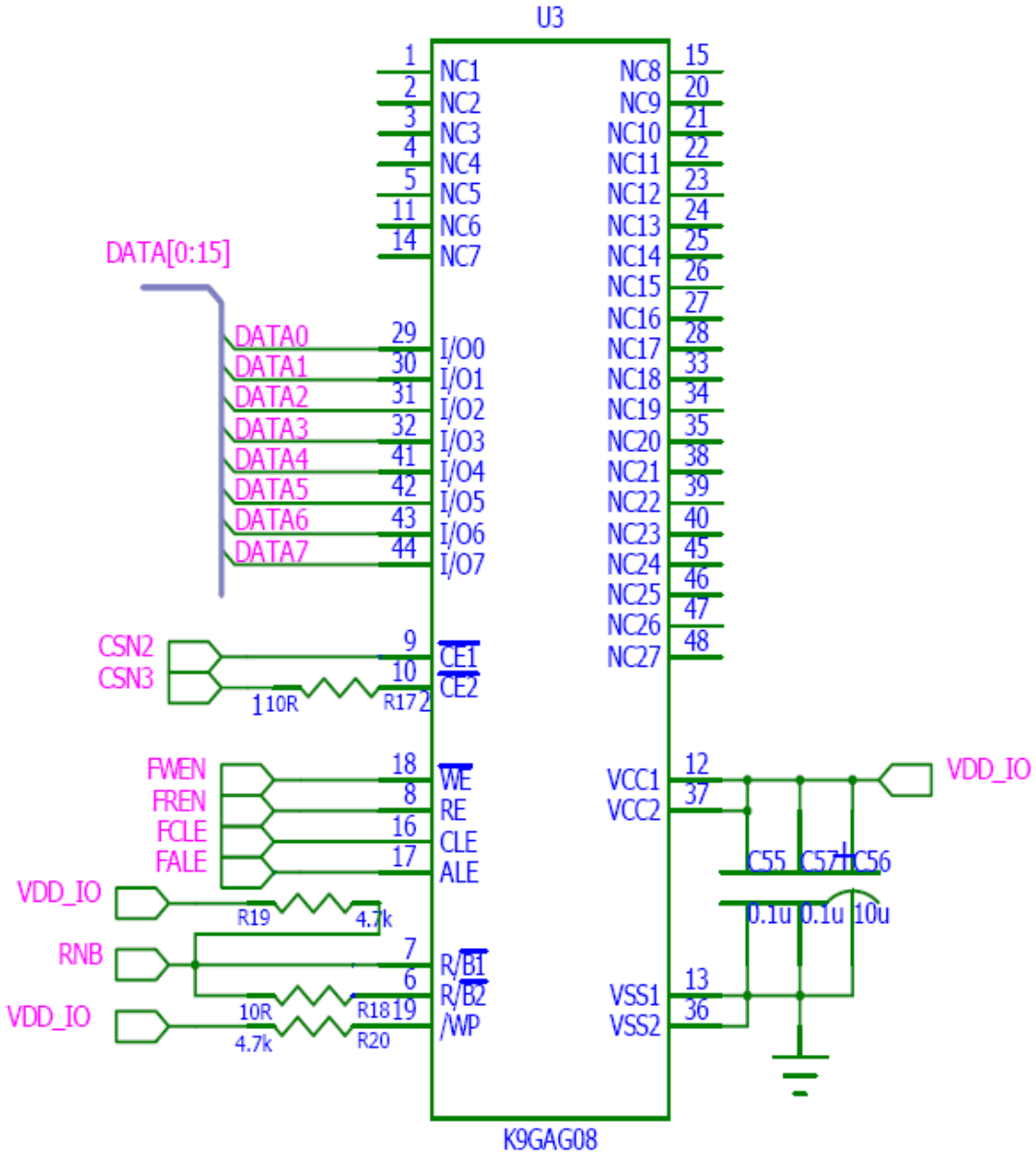
4.1 NAND Flash

Samsung 256MByte K9F2G08U0B / 2GByte K9GAG08U0D NAND Flash chip been integrated on the OK6410-B for storing operating system kernels, applications, filesystems, and other data.

The NAND Flash circuit on the OK6410-B takes CSn2 and CSn3 on the S3C6410 as chip selection signals and supports 128MB-2GB NAND Flash chips. Schematic of the NAND Flash circuit is shown as below:

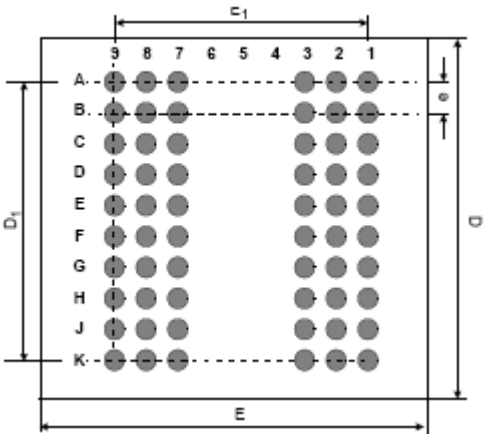
NOTE: while booting from the NAND Flash, both CSn2 AND CSn3 are configured by the S3C6410 MCU as chip selection, therefore the CSn3 cannot be used for connecting other bus devices except for the NAND Flash.


48-pin TSOP1
Standard Type
12mm x 20mm
1 N.C
2 N.C
3 N.C
4 N.C
5 N.C
6 N.C
7 R/B
8 RE
9 CE
10 N.C
11 N.C
12 Vcc
13 Vss
14 N.C
15 N.C
16 CLE
17 ALE
18 WE
19 WP
20 N.C
21 N.C
22 N.C
23 N.C
24 N.C
48 N.C
47 N.C
46 N.C
45 N.C
44 I/O7
43 I/O6
42 I/O5
41 I/O4
40 N.C
39 N.C
38 N.C
37 Vcc
36 Vss
35 N.C
34 N.C
33 N.C
32 I/O3
31 I/O2
30 I/O1
29 I/O0
28 N.C
27 N.C
26 N.C
25 N.C

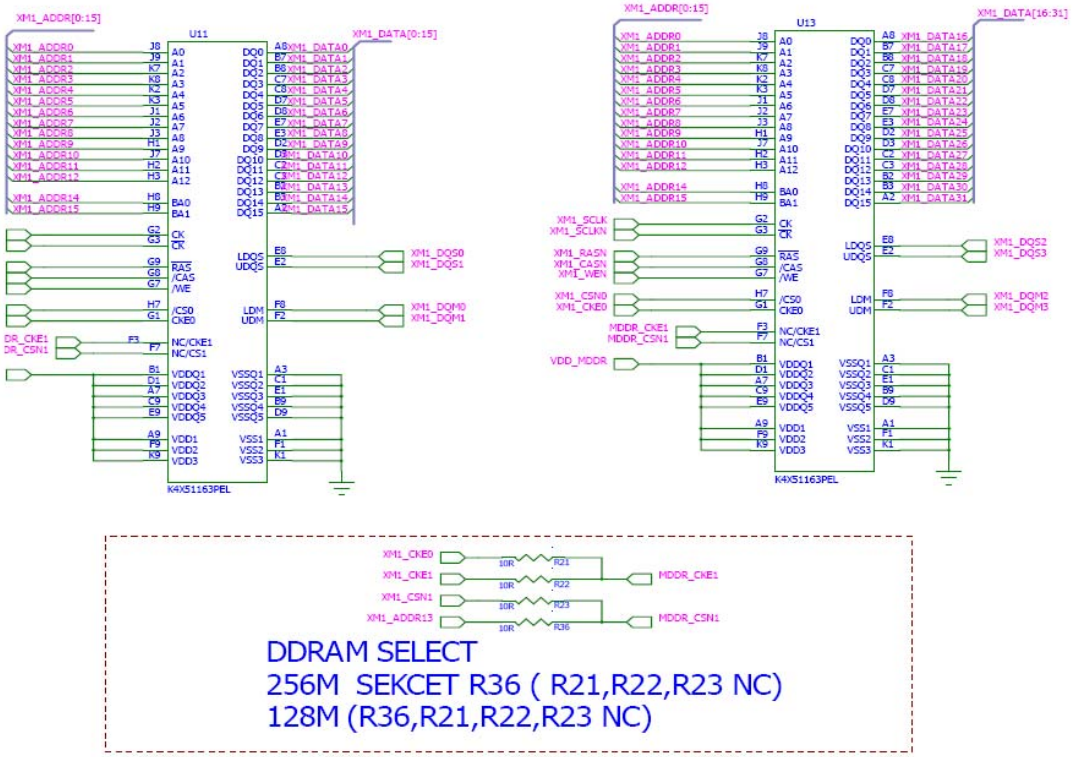

U3
DATA[0:15]
DATA0
DATA1
DATA2
DATA3
DATA4
DATA5
DATA6
DATA7
CSN2
CSN3
R17
10R
FWEN
FREN
FCLE
FALE
VDD_IO
R19
4.7k
RNB
VDD_IO
10R
R18
4.7k
R20
NC1
NC2
NC3
NC4
NC5
NC6
NC7
I/O0
I/O1
I/O2
I/O3
I/O4
I/O5
I/O6
I/O7
CE1
CE2
WE
RE
CLE
ALE
R/B1
R/B2
/WP
NC8
NC9
NC10
NC11
NC12
NC13
NC14
NC15
NC16
NC17
NC18
NC19
NC20
NC21
NC22
NC23
NC24
NC25
NC26
NC27
VCC1
VCC2
VSS1
VSS2
VDD_IO
C55
C57
C56
0.1u
0.1u
10u
K9GAG08

4.2 Mobile DDR RAM

The 128M Bytes Mobile DDR RAM on the OK6410-B Development Board consists of two Samsung K4X51163PC chips, the frequency of the DDRram can reach up to 266MHz.



60Ball(6x9) FBGA						
	1	2	3	7	8	9
A	Vss	DQ15	Vssq	Vddq	DQ0	Vdd
B	Vddq	DQ13	DQ14	DQ1	DQ2	Vssq
C	Vssq	DQ11	DQ12	DQ3	DQ4	Vddq
D	Vddq	DQ9	DQ10	DQ5	DQ6	Vssq
E	Vssq	UDQS	DQ8	DQ7	LDQS	Vddq
F	Vss	UDM	N.C.	N.C.	LDM	Vdd
G	CKE	CK	$\overline{CK}$	$\overline{WE}$	$\overline{CAS}$	$\overline{RAS}$
H	A9	A11	A12	$\overline{CS}$	BA0	BA1
J	A6	A7	A8	A10/AP	A0	A1
K	Vss	A4	A5	A2	A3	Vdd

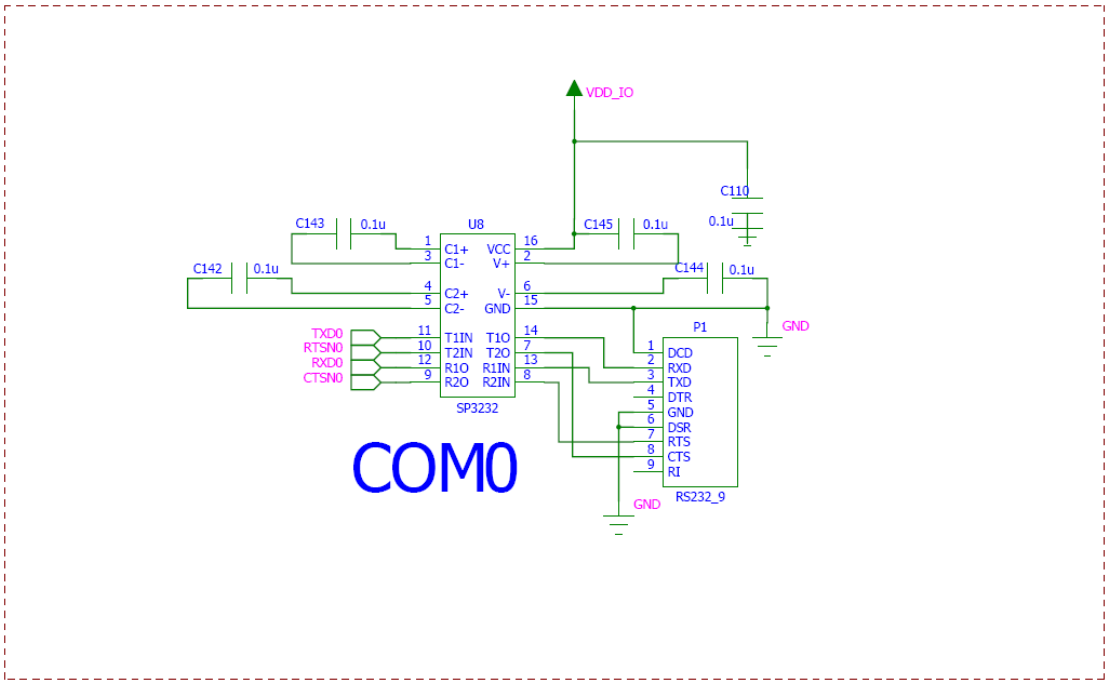


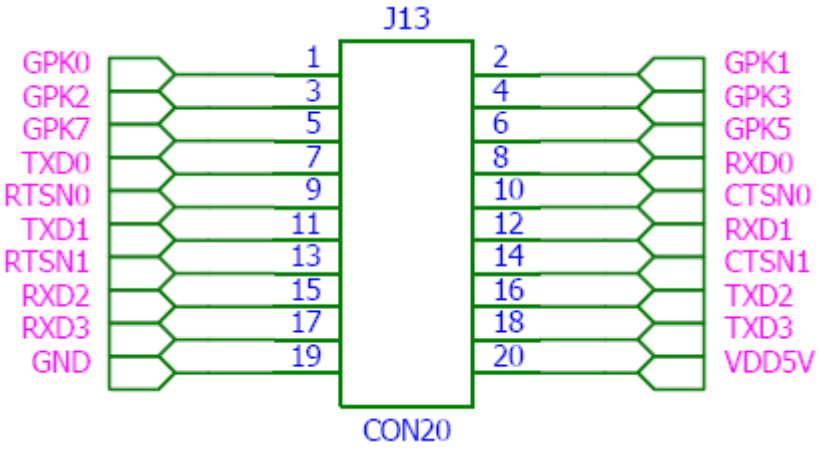
4.3 UART Interfaces

There are totally four serial ports on the OK6410-B Development Board: one 5-wire RS232 serial port (DB9 female) and three 3-wire TTL serial ports.

The COM0 has been used as debug port by default, which can be connected to the PC to display debug information.

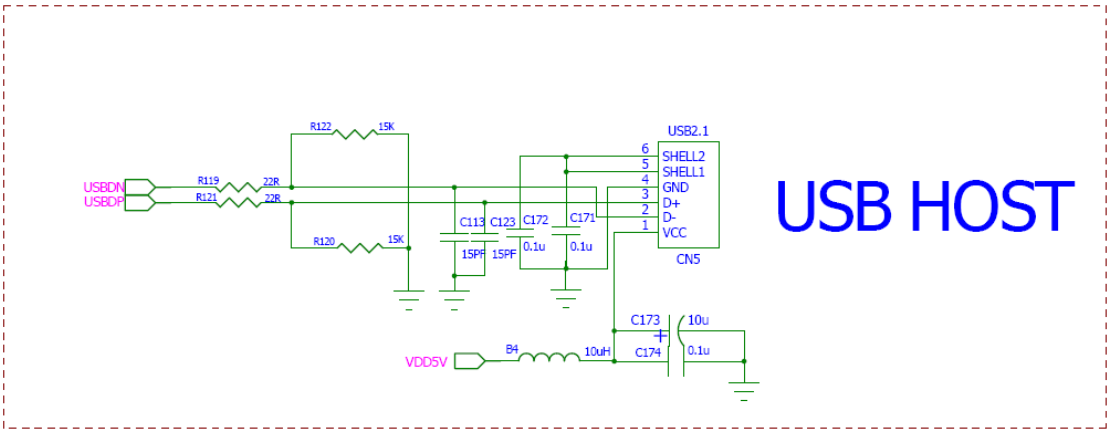
Schematics of the serial ports are shown as below:





4.4 USB Host

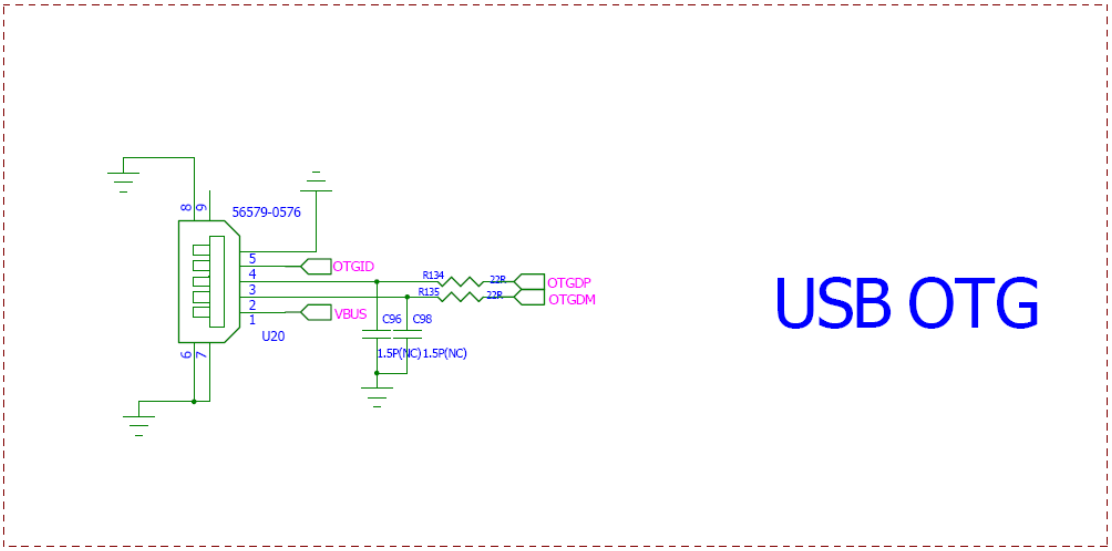
The USB Host interface on the OK6410-B supports USB1.1 protocol; it can be used to connect USB keyboard, USB hard disk, USB mouse, USB memory stick and etc.



4.5 USB OTG

The USB OTG interface (Mini USB A/B port) supports USB 2.0 protocol with the maximum speed up to 480Mbps.

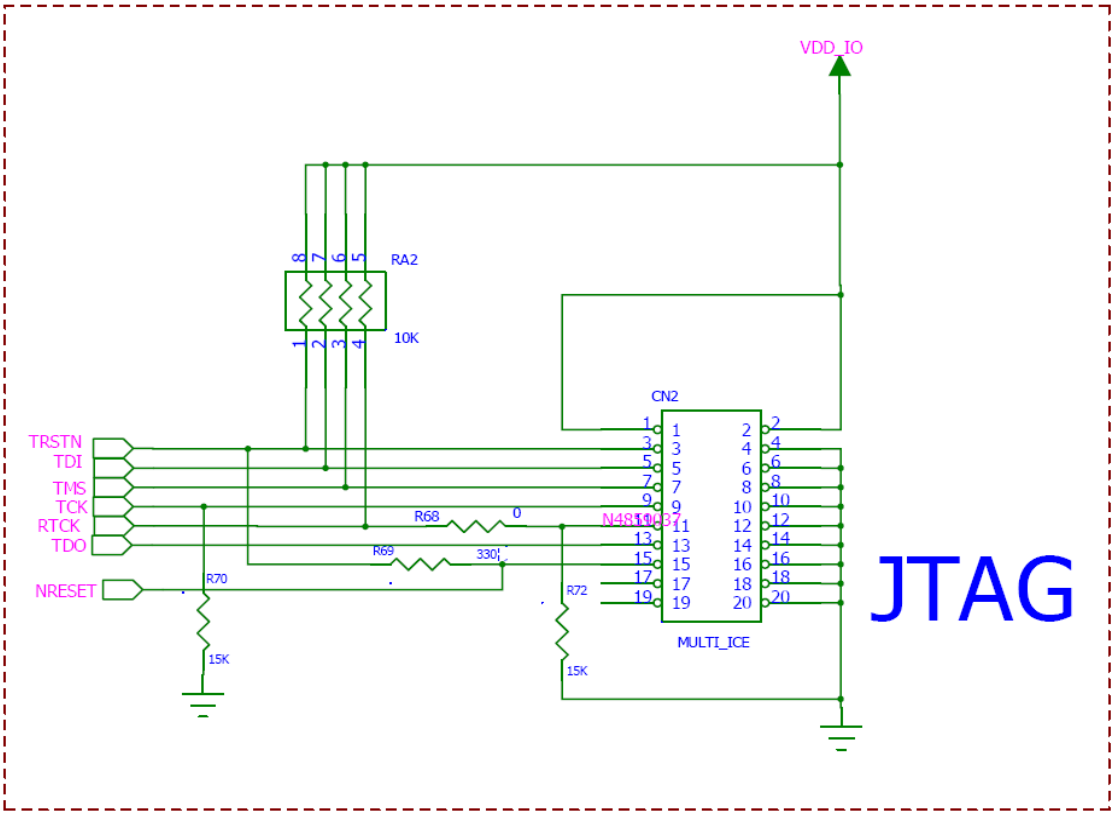
The USB OTG interface can be used for downloading programs and binaries.



4.6 JTAG Interface

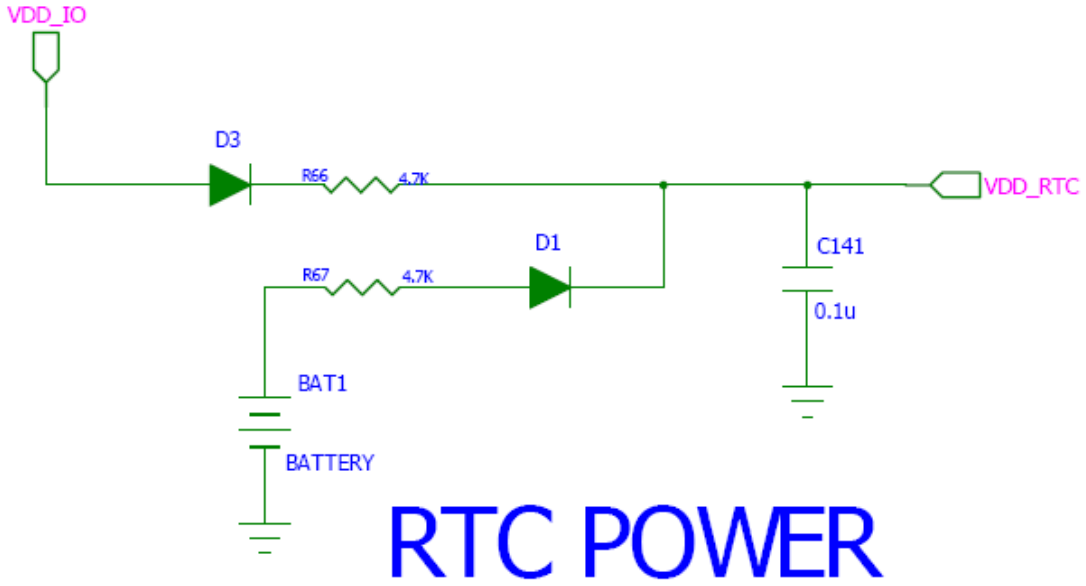
The JTAG interface (CN2) on the OK6410-B provides access to both the ARM11 core and S3C6410 in-chip peripherals, the DBGSEL signal determines which device to access:

When the power level of DBGSEL is high, the JTAG interface provides access to the S3C6410 in-chip peripherals; when the power level of DBGSEL is low, the JTAG interface provides access to the ARM11 core. The power level of DBGSEL can be set by the jumper J9.



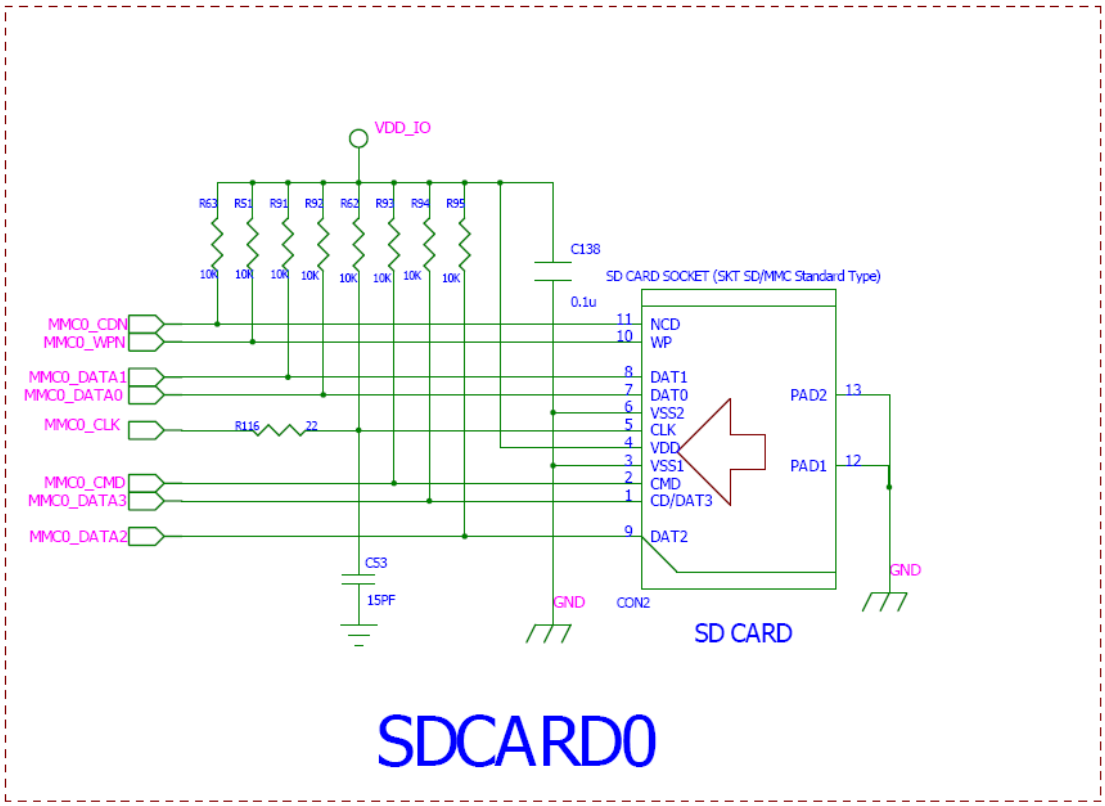
4.7 RTC

The Real Time Clock on the OK6410-B is powered by a button cell (model number CR1220), which supplies the RTC when the power supply is detached from the OK6410-B.



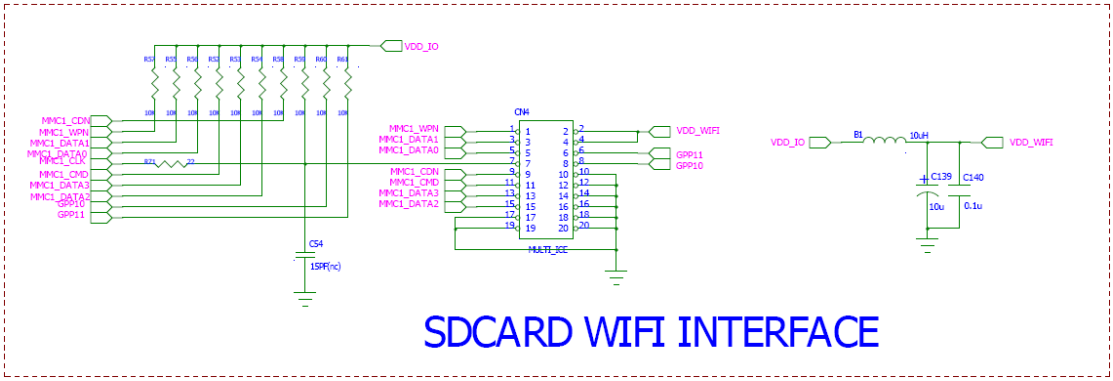
4.8 SD Card Slot

The 4-wire SD card slot supports both SD Memory 2.0 and SDIO 1.0 protocol. As SD memory interface it supports up to 8GB SD card; as SDIO, it can be used to connect WIFI module, GPS module, and etc.



4.9 WIFI Connector

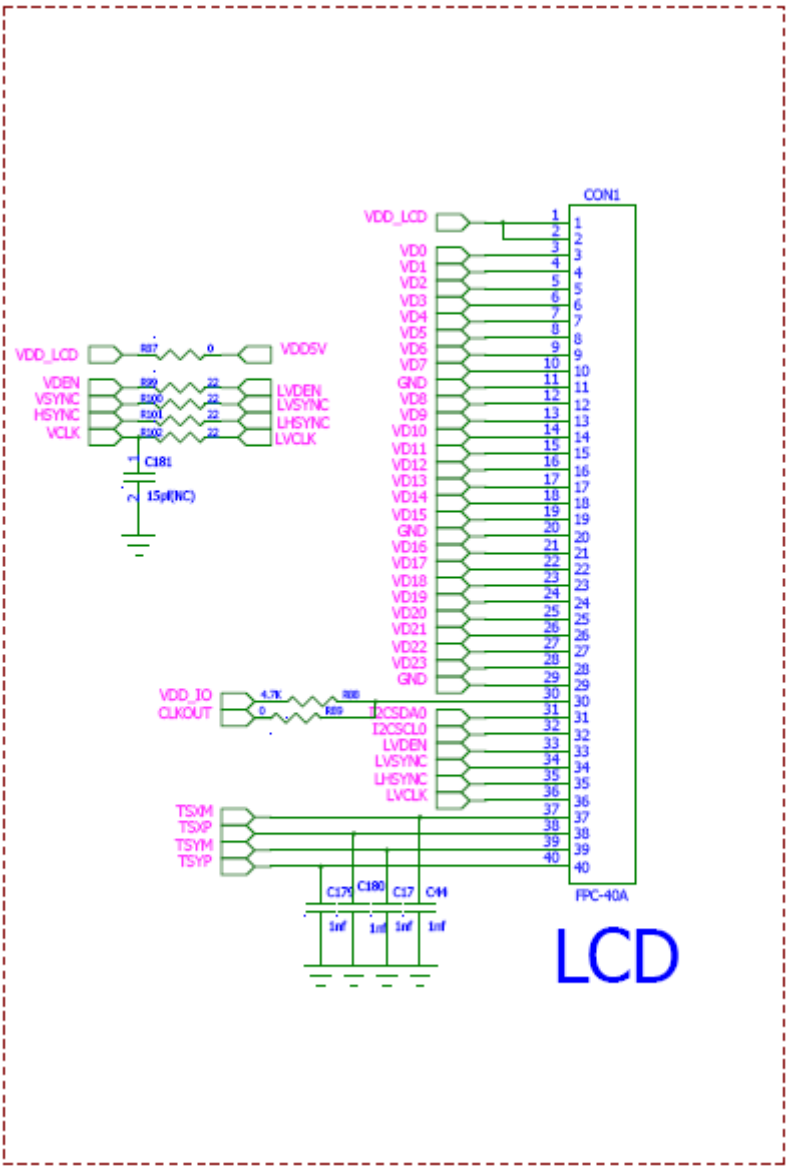
WIFI module and the SD CARD1 interface on the OK6410-B use the same signal channel. Users can choose to use either WIFI or SD card.



4.10 LCD and Touch Screen Interface

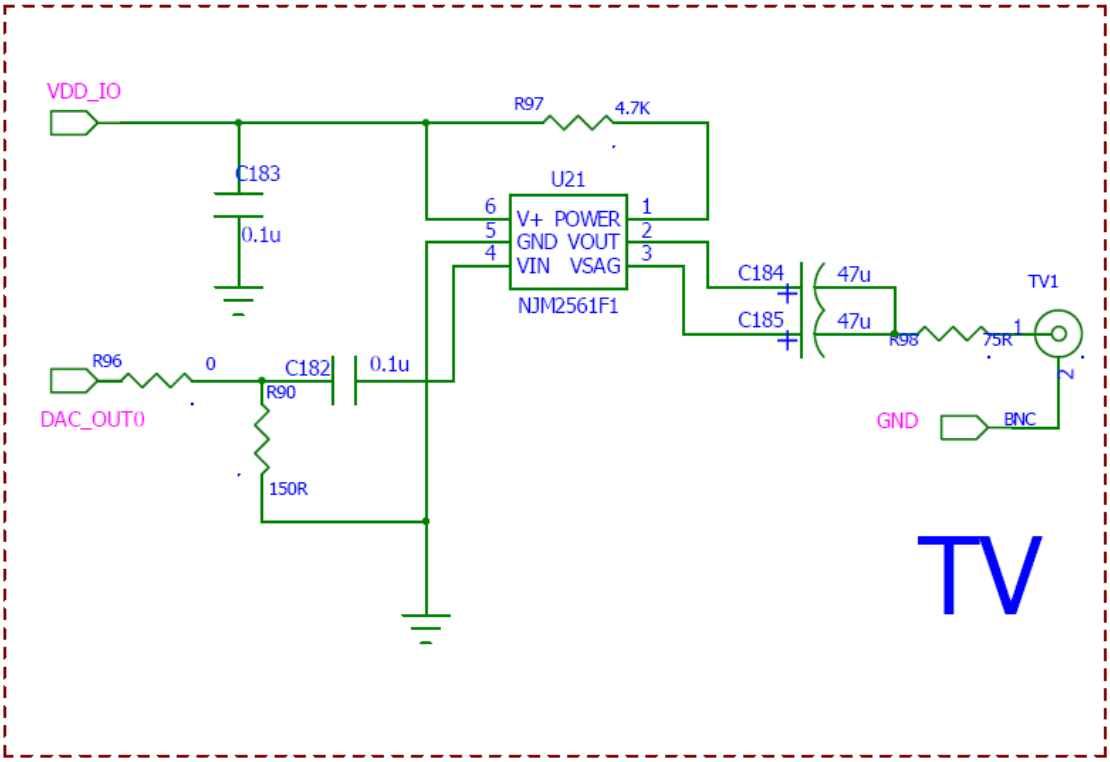
A 50pin 2.0mm pitch connector is used on the OK6410-B as LCD interface, to which we can connect 3.5”, 4.3”, 5.6”, 7”, 8” TFT LCD. All data signals and controlling signals are connected to 22Ω matched resistance to ensure the stability of the signals.

The schematic of the LCD interface is shown as below:



4.11 TV OUT Interface

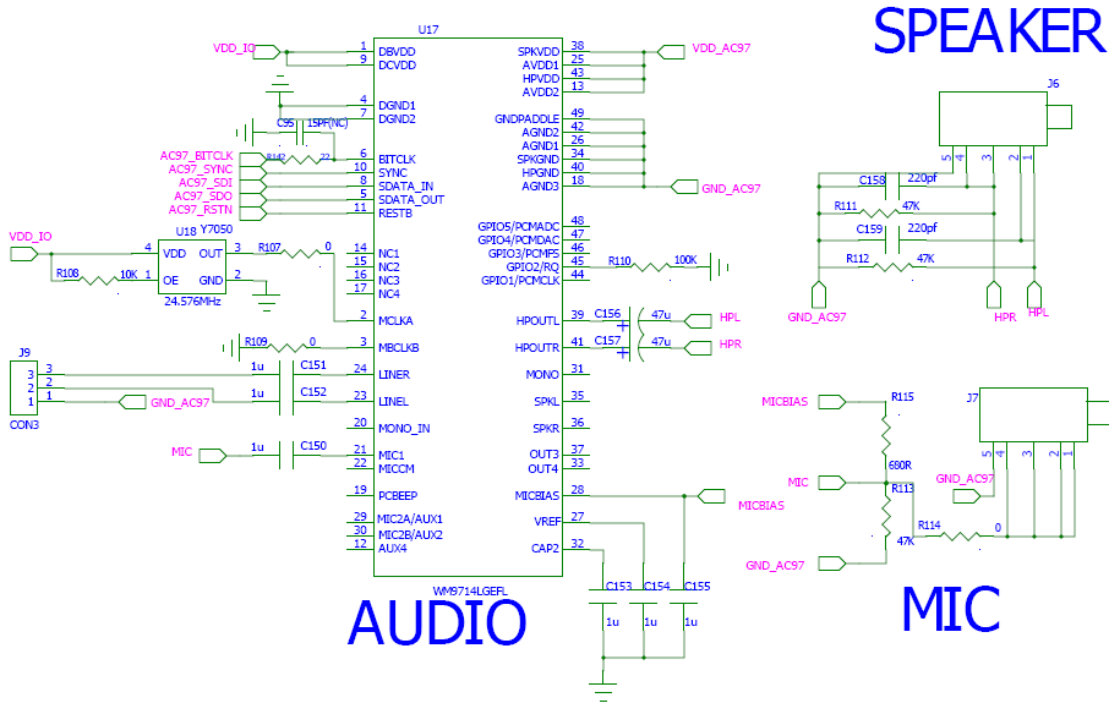
The S3C6410 microcontroller supports TV OUT video output, on the OK6410-B Development Board it is implemented as a 2pin standard TV interface.



4.12 Audio Input/Output

The OK6410-B Development Board takes the AC97 bus on the S3C6410 to implement audio I/O. The WM9714 sound chip realizes audio output, Line in and MIC input.

Details schematic of the audio circuits is as below:



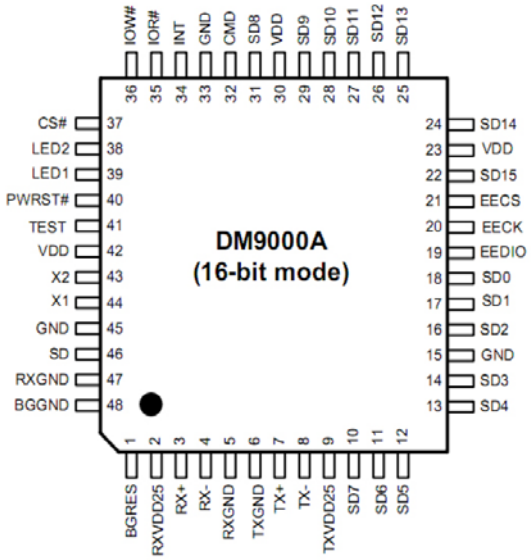
4.13 100M Ethernet

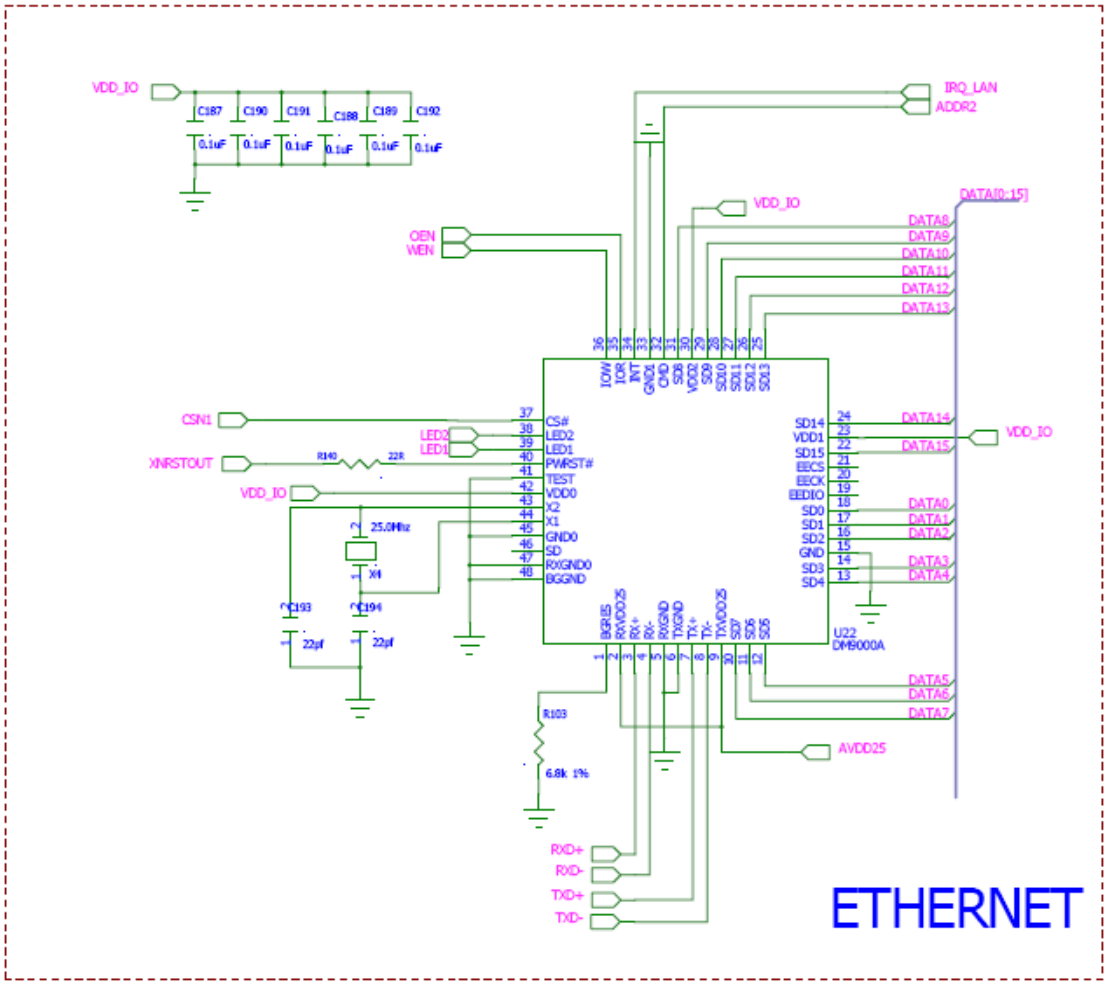
DM9000AE Ethernet chip is used on the OK6410-B to implement 100M Ethernet. During

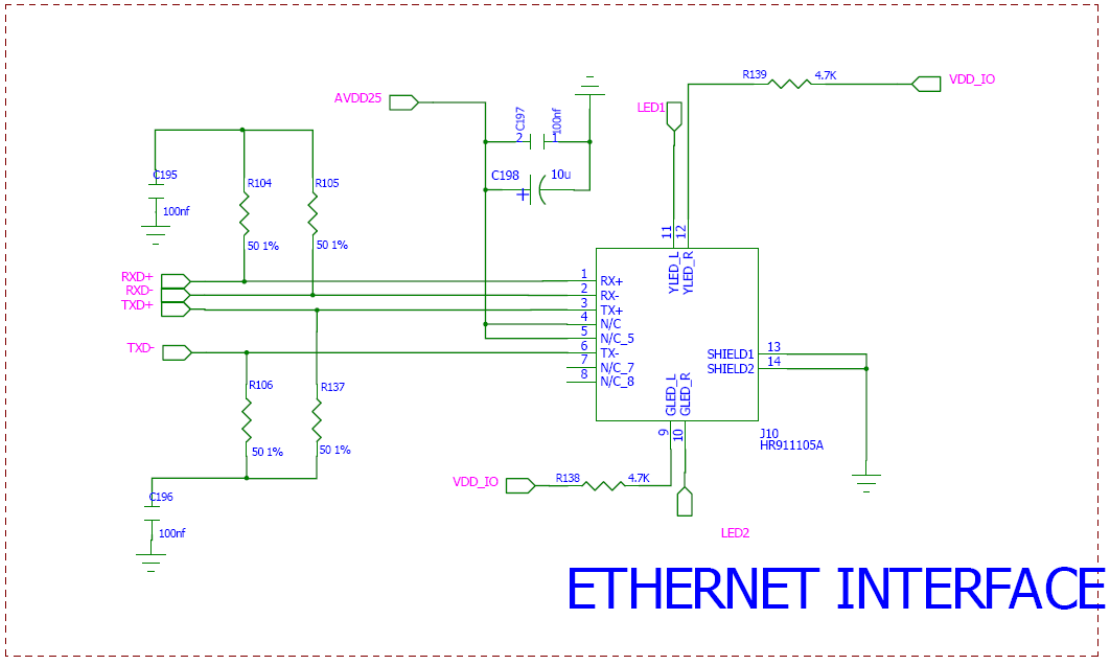
the development, the Ethernet port can be used to download WinCE binaries, mount NFS (Network File System) in Linux. The RJ45 Ethernet interface on the OK6410-B can be connected to PC via cross-over Ethernet cable or to modem/exchanger via straight-through Ethernet cable.

The DM9000AE interrupt signal takes the EINT7 on the S3C6410.

DM9000AE chip selection signal takes the CSN1.





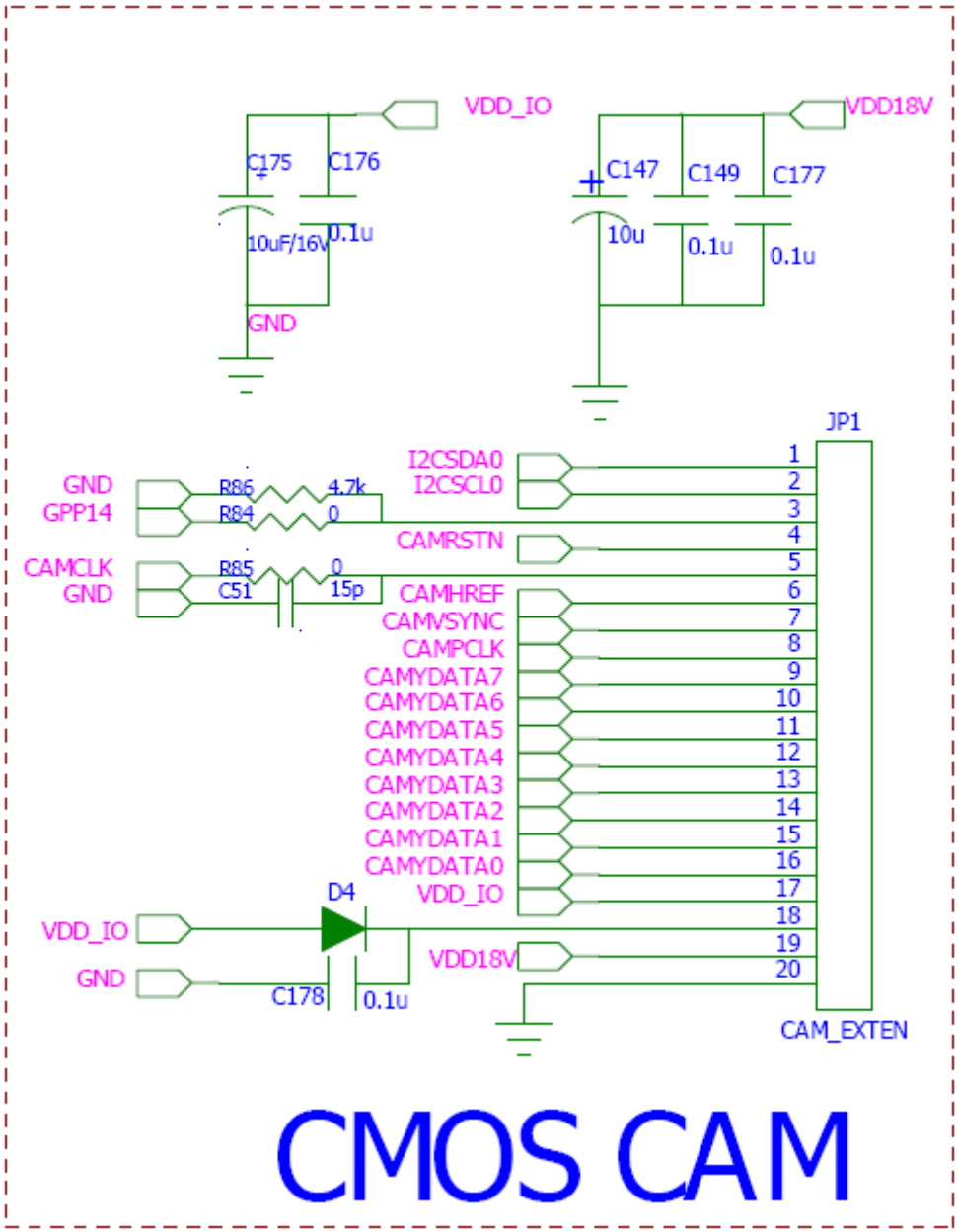


4.14 CMOS Camera Interface

The S3C6410 camera controller supports ITU-BT 601/656 8bit mode, and maximally 4096 x 4096 pixels.

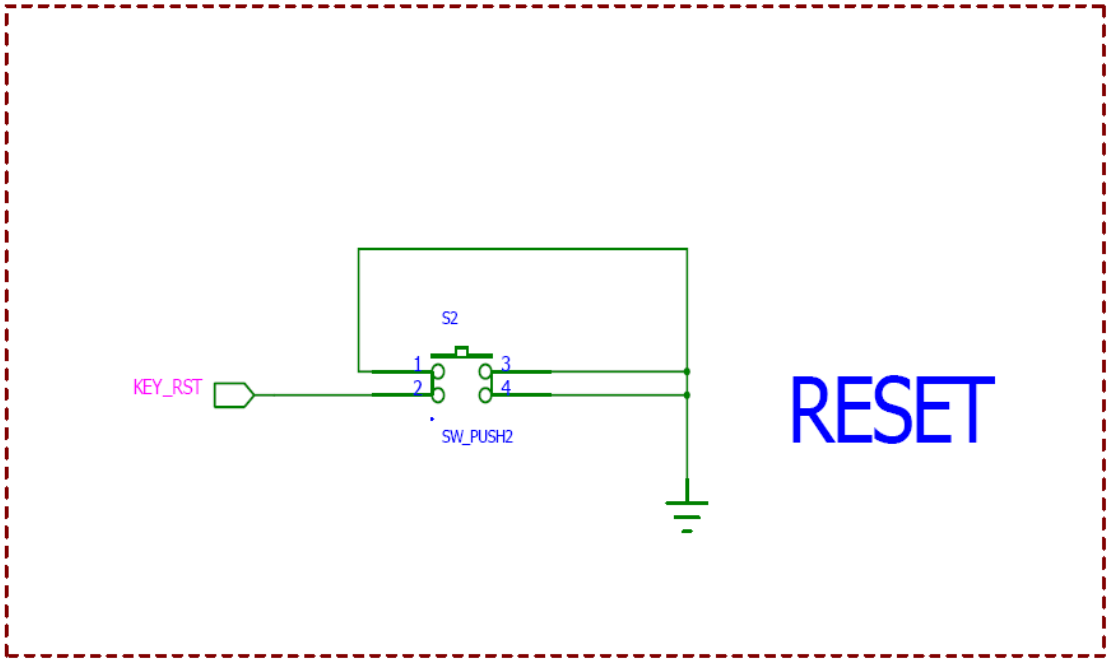
A 2 x 10pin connector is used on the OK6410-B to carry out the camera signals. Beside the camera signals, the CMOS camera interface also contains a IIC signal so that users can configure the camera, as well as a GPIO signal (GPP14) which carries out power management function.

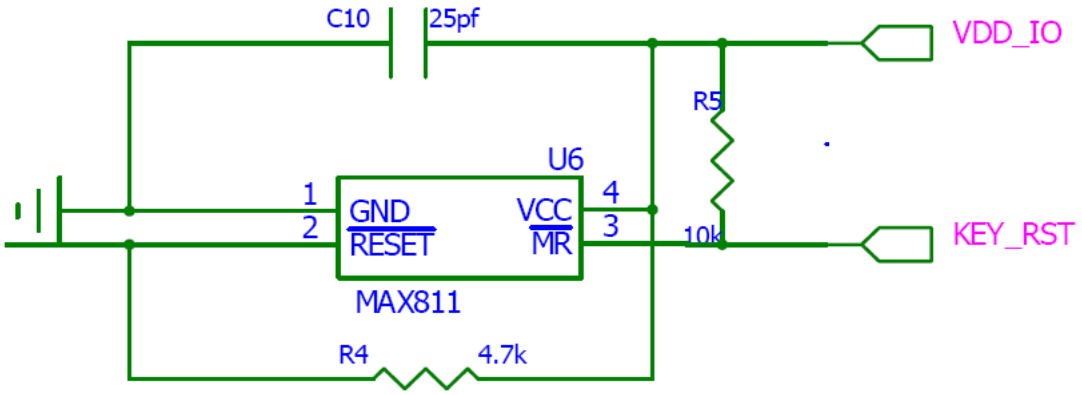
The schematic of the CMOS camera interface is shown as below:



4.15 Reset System

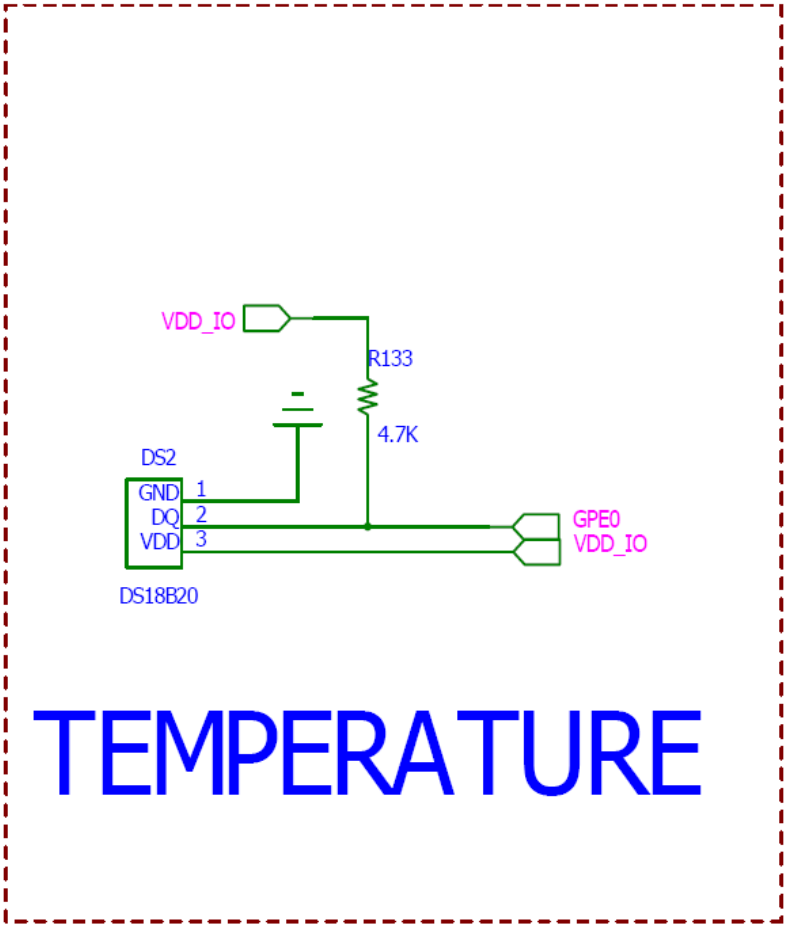
The reset system on the OK6410-B consists of a 6 x 6mm sensitive button and a MAX811t reset chip on the core board.

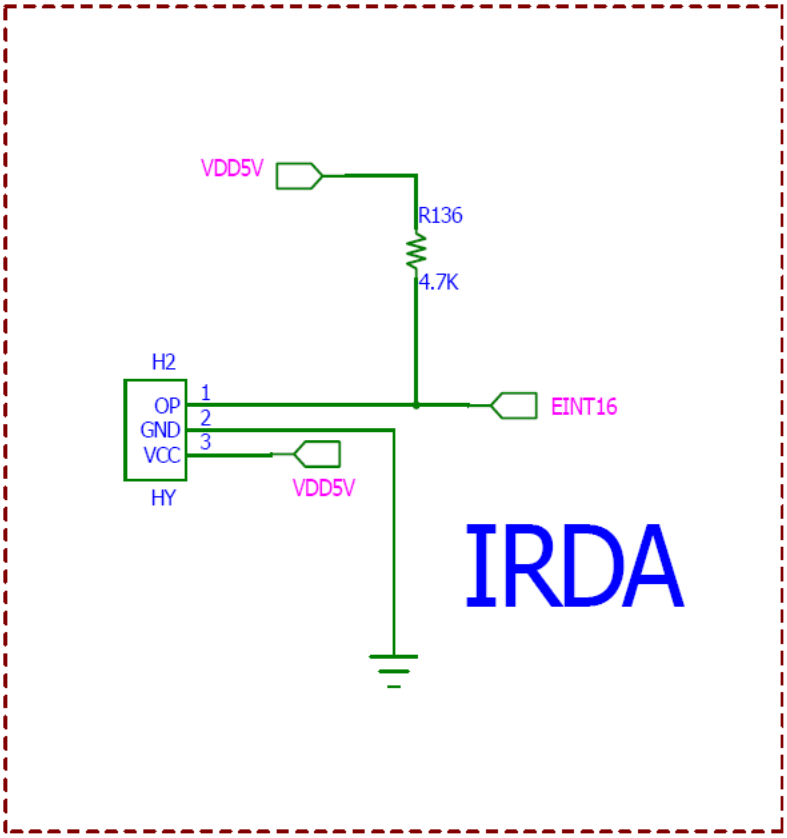




4.16 Temperature Sensor & IRDA

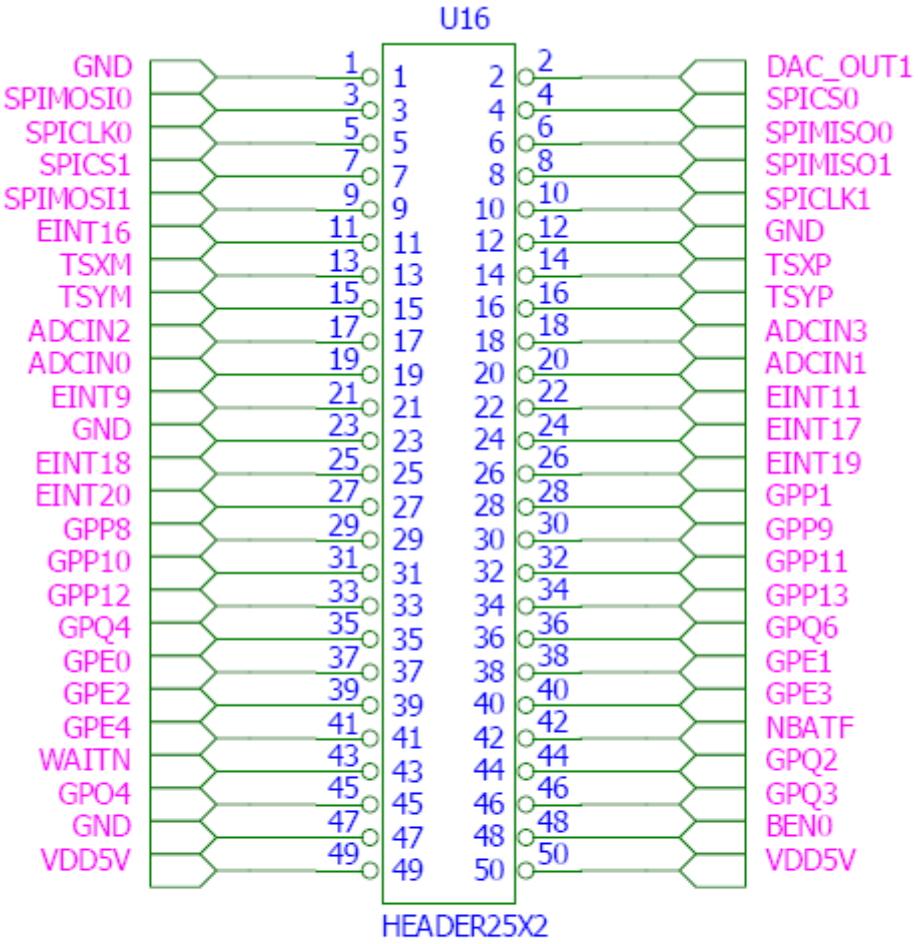
On the OK6410-B there integrated a DS18B20 temperature sensor and a HS0038B infrared receiver:


VDD_IO
R133
4.7K
DS2
GND 1
DQ 2
VDD 3
GPE0
VDD_IO
DS18B20
TEMPERATURE


VDD5V
R136
4.7K
H2
OP 1
GND 2
VCC 3
HY
EINT16
VDD5V
IRDA

4.17 User IO

2 x 25pin GPIO pins are reserved on the OK6410-B for the users,



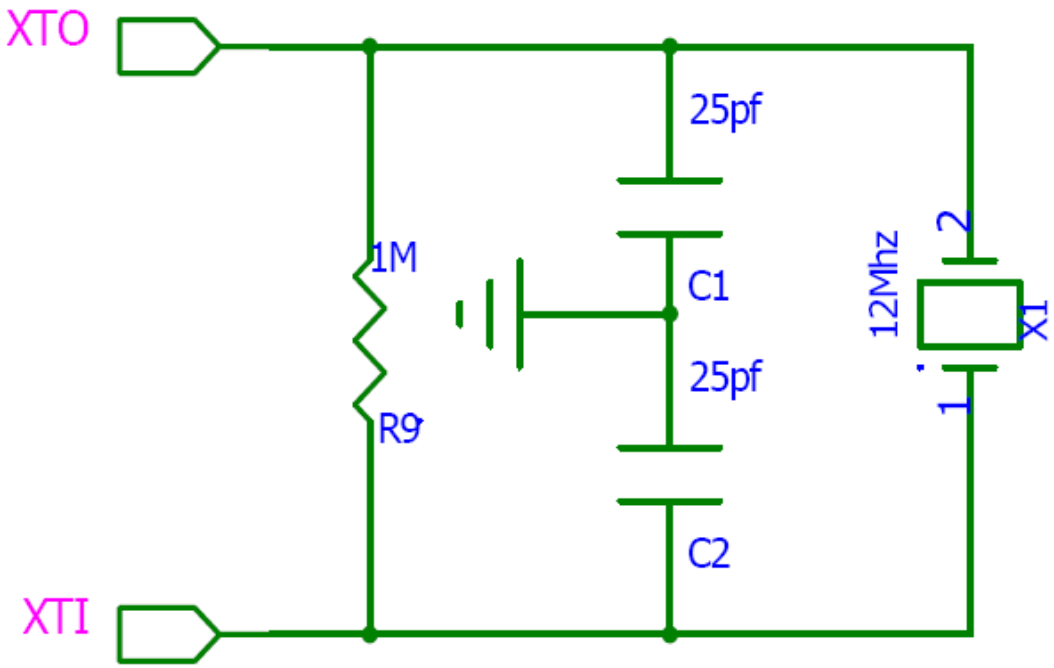
USER IO

5. Crystals and Power Management

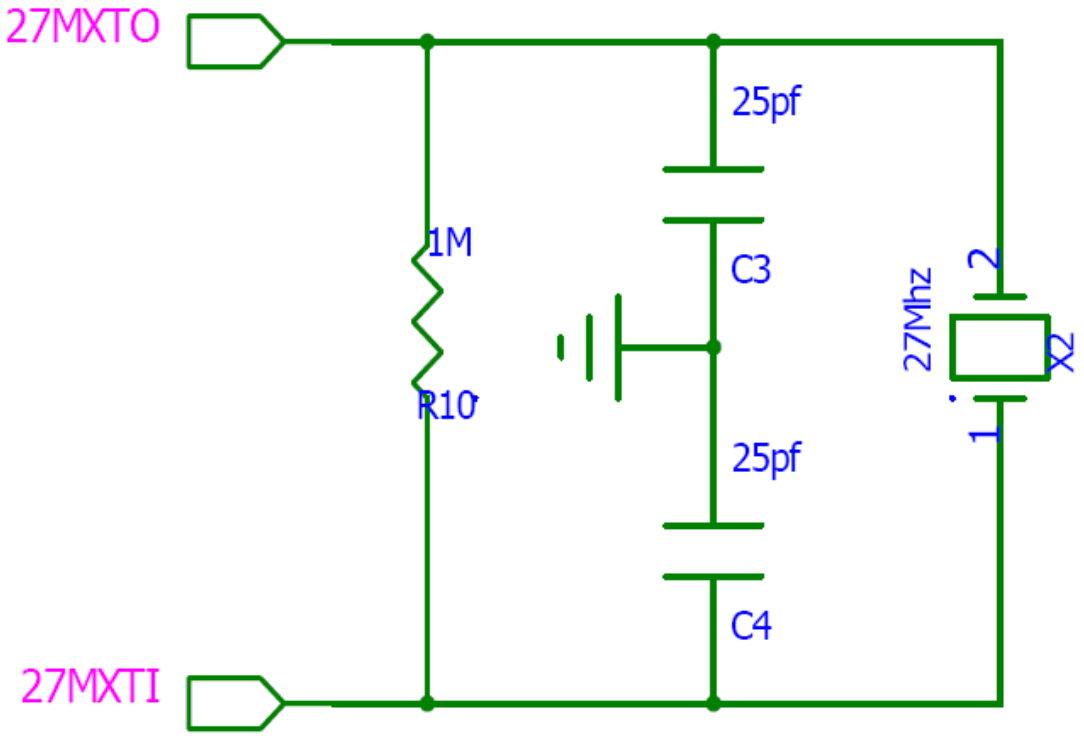
5.1 Crystals

There are six crystal sources on the OK6410-B.

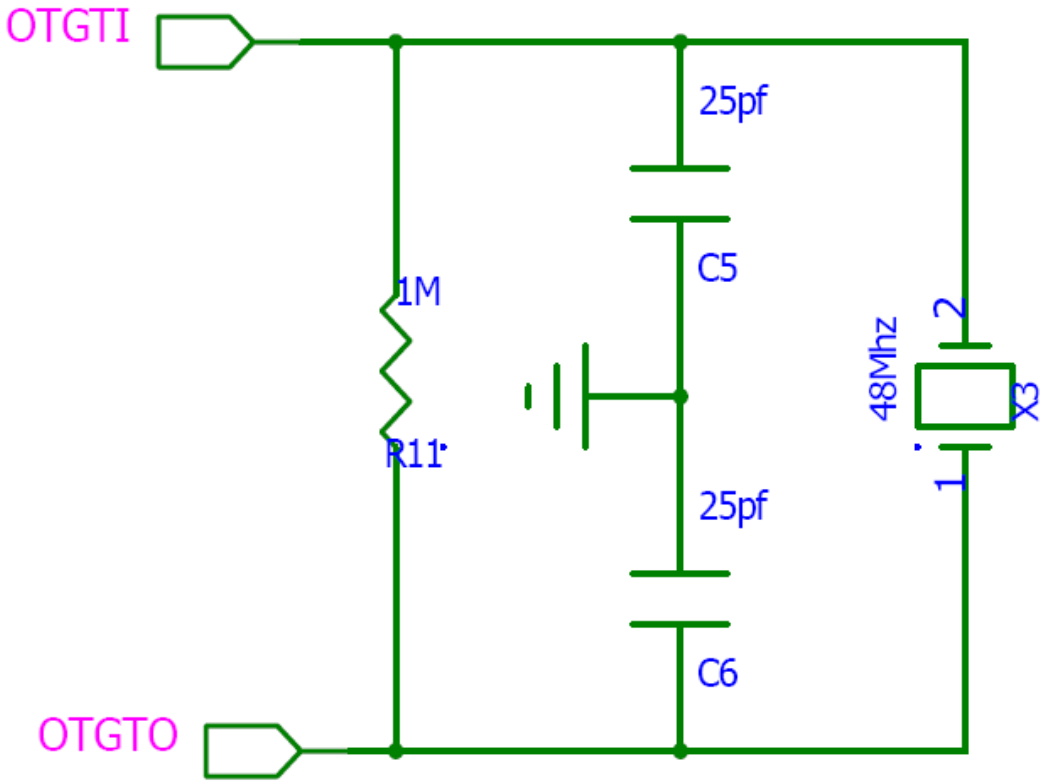
1. Main clock 12MHz



2. Graphics Clock, 27Hz, providing clock signals for display modules such as MFC, LCD, TV.

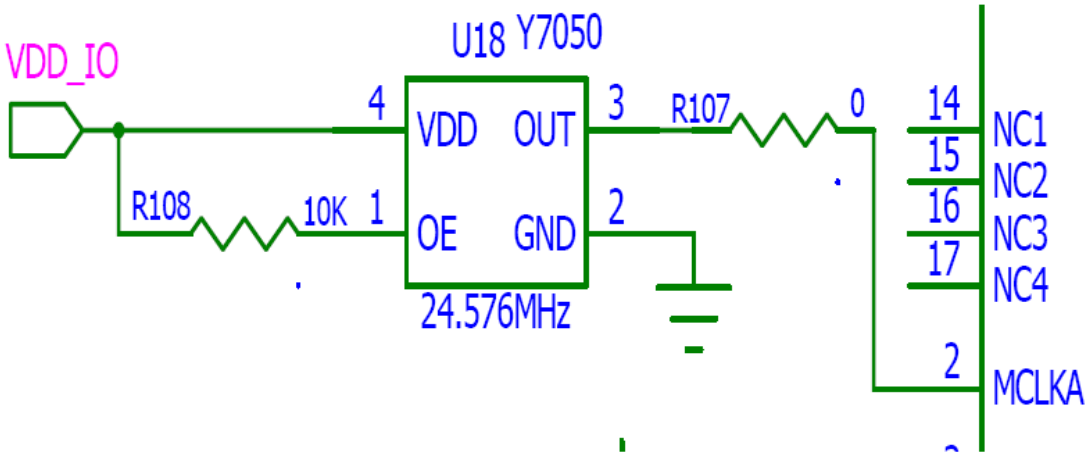


3. 48MHz USB Clock, providing clocking signals for USB, SD card, SDIO:

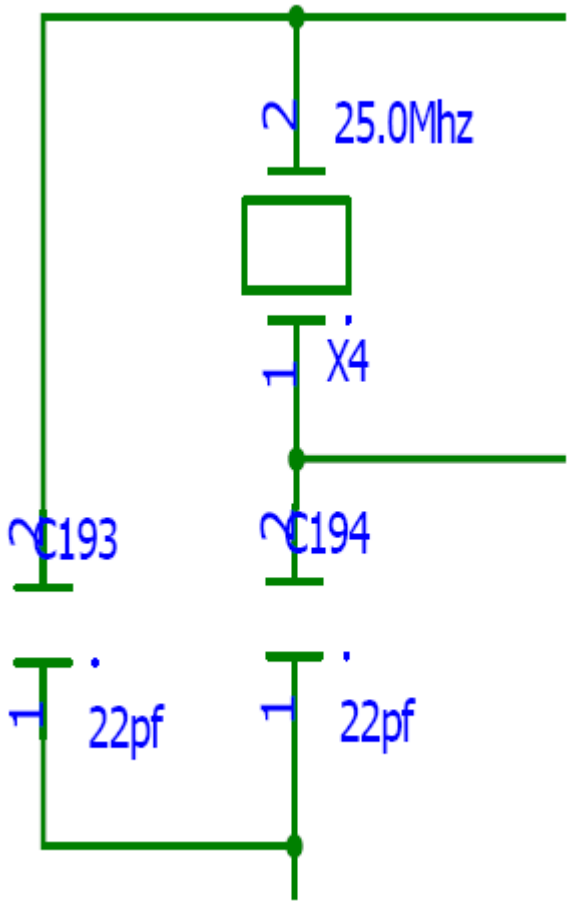


4. 32.768 KHz RTC clock for Real Time Clock

5. 24.576MHz crystal providing MCLKA to WM9714 and then to AC97:



6. 25M crystal for DM9000AE.



5.2 Power Management Units

The S3C6410 I/O power management and function description is listed as below:

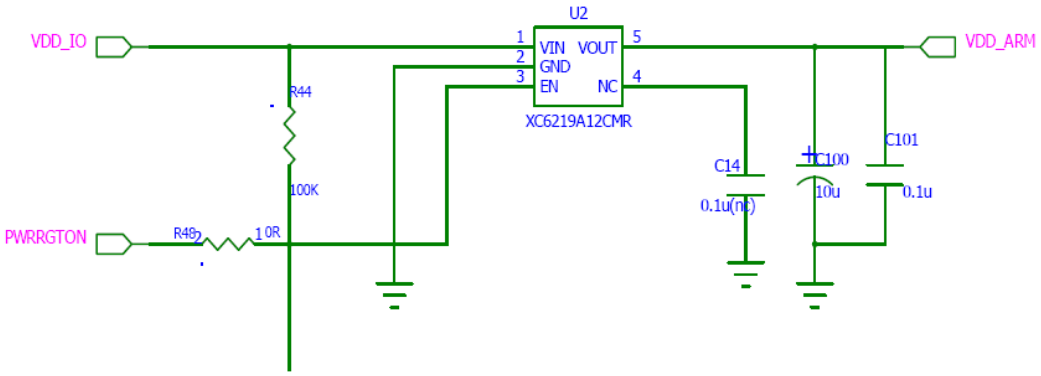
Input (I)/Output (O) Type	Descriptions
dih(vddivh), si(vssipvh)	Vdd/Vss for internal logic with internal pad power ring
dich(vddicvh)	Vdd for only internal logic
dth(vddtvh), sth(vsstvh)	1.8~3.3V Vdd/Vss for external logic
dtm(vddtvm)	1.8~2.5V Vdd for external logic
dtlh(vddtvlh), stlh(vsstvlh)	1.2V Vdd/Vss for external and internal logic
drtc(vddrtcvh)	1.8~3.0V Vdd for RTC power
dih_u(vddivh_usb)	Vdd for usb phy core
si_u(vssipvh_usb)	Vss for usb phy core
hag(pvhbsudtartg)	1.8V~3.3V Wide Range Bi-directional Buffer with Schmitt Trigger Input, Controllable Pull-up/down Resistor and A type Output driver
hag_a (pvhbsudtag_alv)	1.8V~3.3V Wide Range Bi-directional Alive Buffer with Schmitt Trigger Input, Controllable Pull-up/down Resistor and A type Output driver
hbg(pvhbsudtbrtg)	1.8V~3.3V Wide Range Bi-directional Buffer with Schmitt Trigger Input, Controllable Pull-up/down Resistor and B type Output driver
mbg(pvmbsudtbrtg)	1.8V~2.5V Wide Range Bi-directional Buffer with Schmitt Trigger Input, Controllable Pull-up/down Resistor and B type Output driver

sca(pvhsosca)	1.8V~3.3V wide range oscillator for RTC Interface
scb(pvhsoscbrt)	1.8V~3.3V wide range oscillator for Wide Frequency
usb1(usb6002x1)	USB 1.1 pad
hr(pvhbr)	1.8V~3.3V wide range analog bi-direction path-through PAD with 3 different paths which have no resistor, 50ohm or 100ohm resistor
htr(pvhtbr)	1.8V~3.3V wide range analog tolerant bi-direction path-through PAD with 3 different paths which have no resistor, 50ohm or 100ohm resistor
htr00(pvhtbr00_efuse)	1.8V~3.3V wide range analog bi-direction path-through PAD without resistor for efuse memory
r_h(pvbr_h)	1.2V bi-direction path-through PAD with 3 different paths which have no resistor, 50ohm or 100ohm resistor

We can see that the S3C6410 CPU needs more than one power supplies. Several power management units are implemented on the OK6410-B, each unit are supplied by separate power supply chip to improve stability and security of power supply.

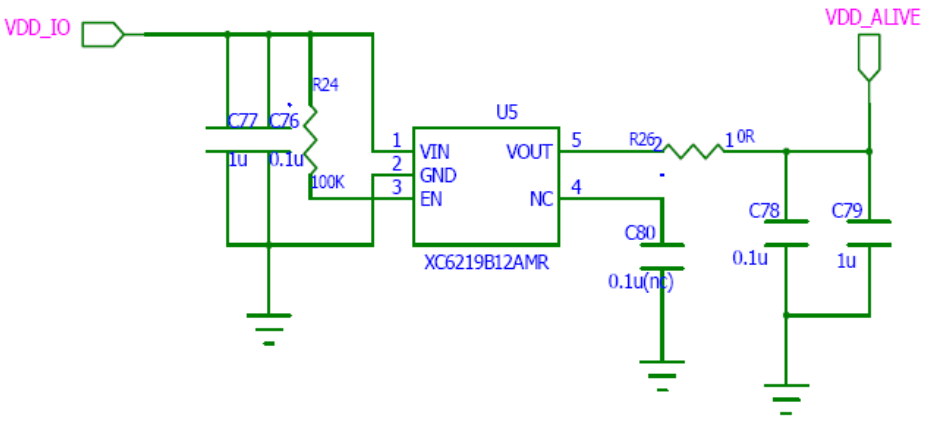
1. Power supply for S3C6410 ARM CORE

Signal	Description	Voltage
VDDARM	Internal power for ARM1176 core and cache	1.2



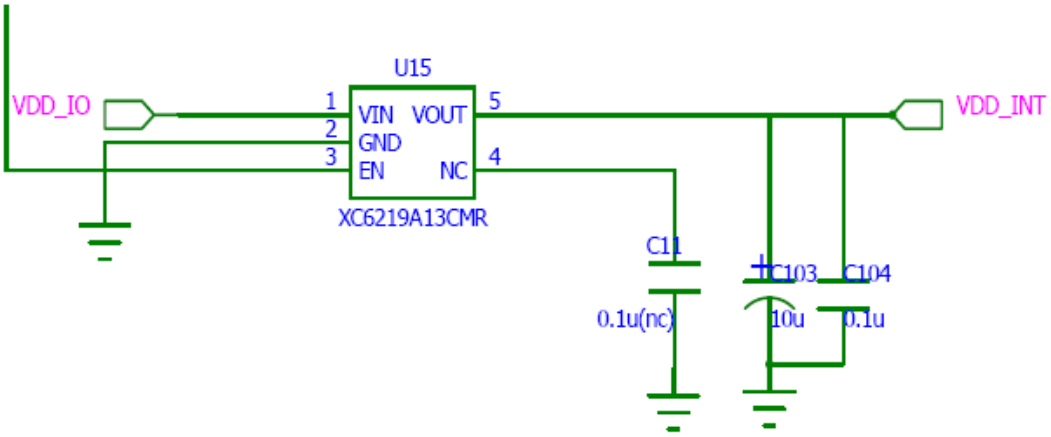
2. Power supply for S3C6410 ALIVE

Signal	Description	Voltage
VDDALIVE	Internal power for alive block	1.2



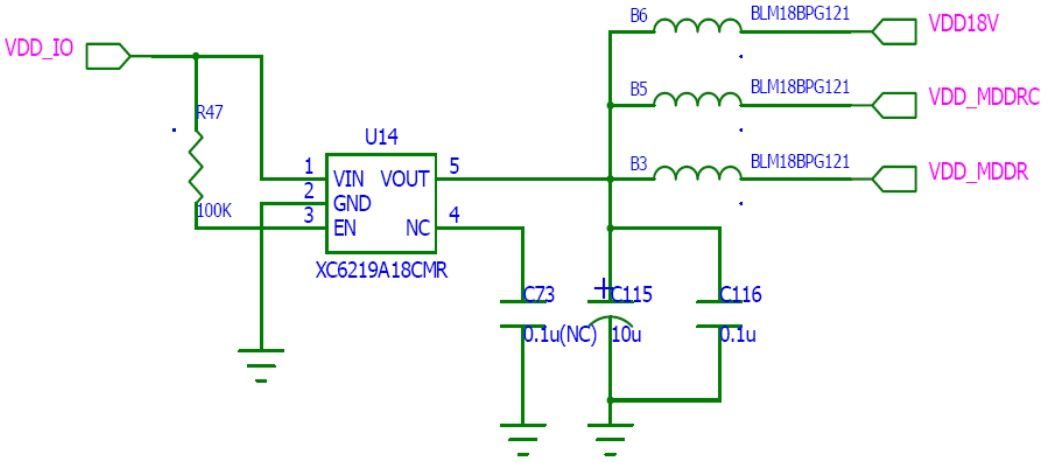
3. 2. Power supply for S3C6410 Logic

Signal	Description	Voltage
VDDINT	Internal power for logic	1.2



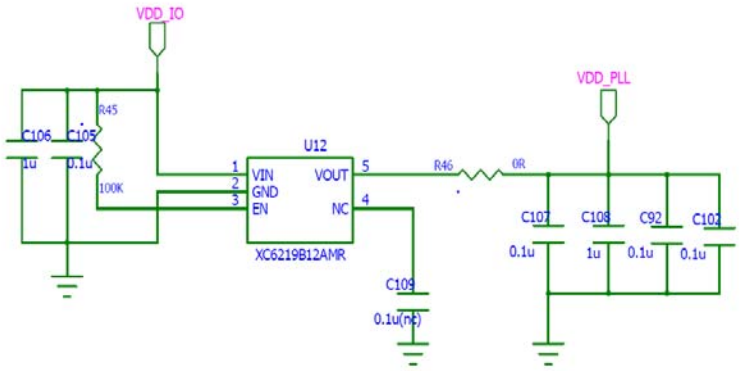
3. 4. Power supply for S3C6410 Mobile DDR

Signal	Description	Voltage
VDDM1	IO power for Memory Port 1	1.8



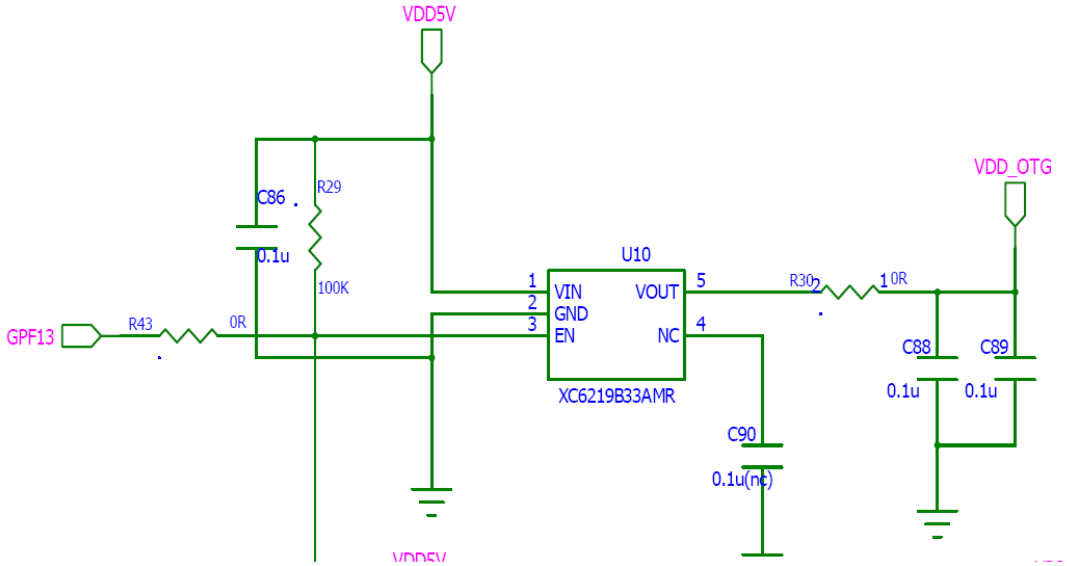
3. 5. Power supply for S3C6410 PPL

Signal	Description	Voltage
VDDPPL	Power for PLL core	1.2



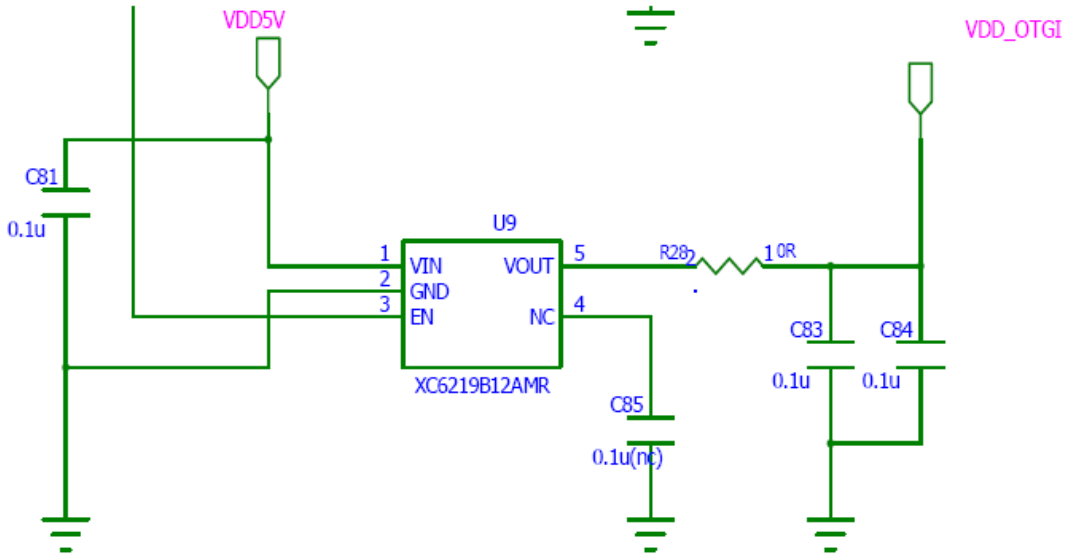
3. 6 Power supply for S3C6410 OTG

Signal	Description	Voltage
VDDOTG	Power for USB OTG PHY	3.3

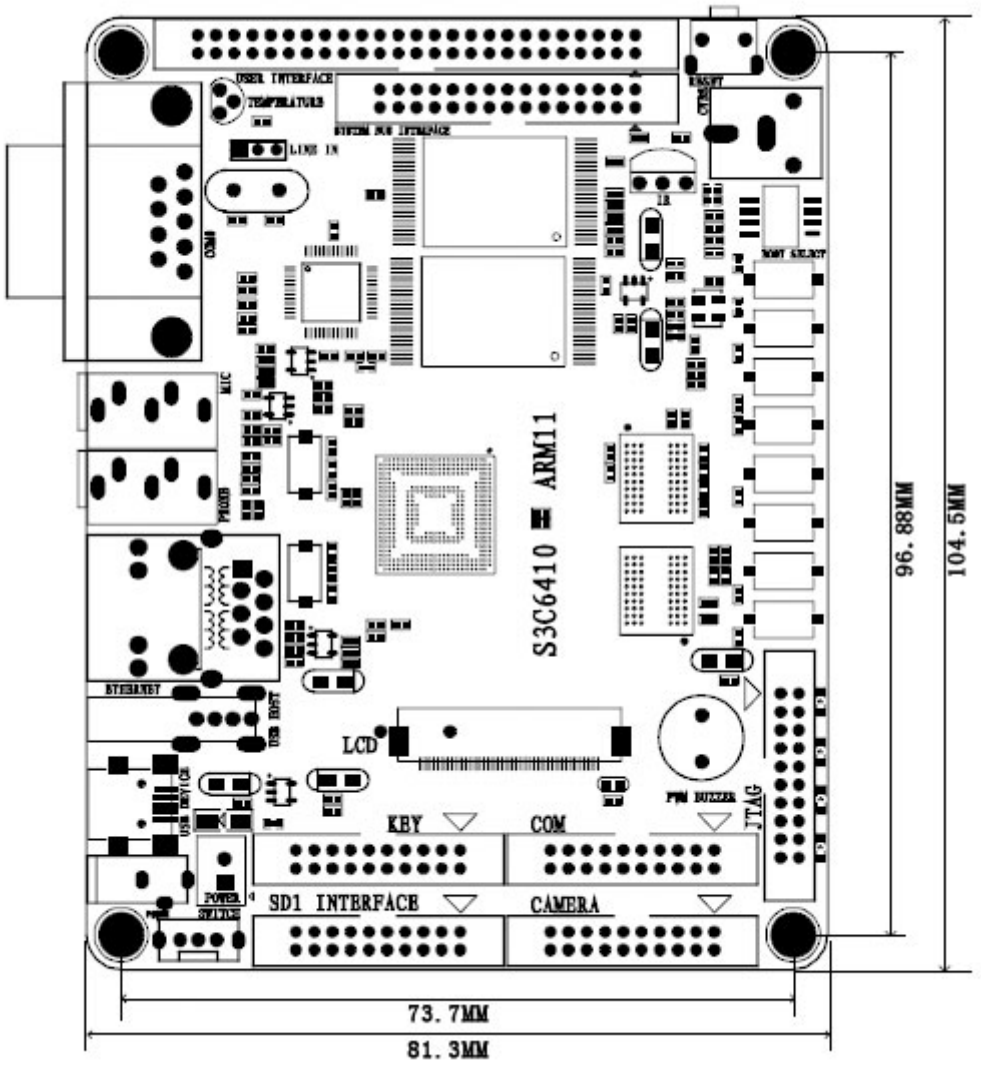


3. 7 Power supply for S3C6410 OTGI

Signal	Description	Voltage
VDDOTGI	Internal Power for USB OTG PHY	1.2


VDD5V
VDD_OTGI
C81
0.1u
U9
1
2
3
VIN
GND
EN
VOUT
NC
5
4
XC6219B12AMR
R28
10R
C83
0.1u
C84
0.1u
C85
0.1u(nc)

6. Layout


S3C6410 ARM11
LCD
KEY
COM
JTAG
SD1 INTERFACE
CAMERA
96.88MM
104.5MM
73.7MM
81.3MM